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REMARKS/ARGUMENTS

Claims 1-23 and 30-35 are pending in this application. By this amendment, Applicants amend claims 1 and 13.

Claims 1-5, 8-17 and 20-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. (U.S. 2002/0180035) in view of Weber (U.S. 5,609,889). Claims 6 and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Weber, and further in view of Punzalan et al. (U.S. 2003/0160309). Claims 7 and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Weber, and further in view of Cheng et al. (US 2003/0075812). Claims 30 and 33 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Weber, and further in view of Mayer (US 2003/0226253). Claims 31, 32, 34 and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Weber, and further in view of Fang (US 2003/0189245). Applicants respectfully traverse the rejections of claims 1-23 and 30-35.

Claim 1 has been amended to recite:

"A process for manufacturing an integrated circuit package comprising:

- mounting a semiconductor die to a first surface of a substrate;
- mounting a die adapter to said semiconductor die;
- wire bonding said semiconductor die to ones of conductive traces at said first surface of said substrate;
- mounting at least one collapsible spacer to at least one of a heat spreader, said die adapter and said substrate;
- placing one of said heat spreader and said substrate on a surface of a lower mold die;

- releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity, such that said other of said heat spreader and said substrate is in contact with said upper mold die and said collapsible spacer is disposed and compressed between said heat spreader and said substrate to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die;

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molding the semiconductor die, the substrate, the wire bonds, said die adapter, said at least one collapsible spacer and said heat spreader into a molding compound by molding in a mold cavity between said heat spreader and said substrate, resulting in a molded package having said at least a portion of said substrate exposed and at least a portion of said heat spreader exposed from said molded package prior to singulating;

forming a ball grid array on a second surface of said substrate, bumps of said ball grid array being electrically connected to said conductive traces; and

singulating said integrated circuit package." (emphasis added)

Claim 13 recites features and method steps that are similar to the features and method steps recited in claim 1, including the above-emphasized features.

The Examiner alleged that Huang et al. teaches a process for manufacturing a plurality of integrated circuit packages that includes each and every feature recited in Applicants' claims 1 and 13, except for the steps of placing one of said heat spreader array and said substrate array on a surface of a lower mold die, and releasably clamping the other of said heat spreader array and said substrate array to an upper mold die. The Examiner further alleged that "Huang [et al.] would look to one such as Weber for preventing molding from covering the bottom surface of the substrate array...".

The Examiner appears to have ignored our previous arguments that Huang et al. clearly teaches away from having one of the heat spreader and the substrate disposed on the surface of the lower mold die with the other of the heat spreader and the substrate in contact with a surface of the upper mold die. In addition, as previously argued, the step of molding performed in Huang et al. does not result in a molded package having at least a portion of a substrate and at least a portion of the heat spreader that is exposed from the molded package. Instead, the step of molding performed in Huang et al. results in a molded package in which the heat spreader (heat sink module plate 23A) is completely covered by the gold layer 233A which is completely covered by molding material after the step of molding. Therefore, no portion

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of the heat spreader (heat sink module plate 23A) or the gold covering is exposed after the step of molding.

Claim 1 has been amended to recite the features of "molding the semiconductor die, the substrate, the wire bonds, said die adapter, said at least one collapsible spacer and said heat spreader into a molding compound by molding in a mold cavity between said heat spreader and said substrate, resulting in a molded package having said at least a portion of said substrate exposed and at least a portion of said heat spreader exposed from said molded package **prior to singulating**" (emphasis added).

Huang et al. clearly teaches away from the present invention as recited in Applicants' claims 1 and 13. Huang et al. specifically discloses that the heat sink 23A **must** be spaced away from the top wall of the mold cavity during molding. In paragraph 36 on page 3 of Huang et al., Huang et al. teaches that "the combined structure of the heat sink module plate 23A, the chips 21 and the substrate module plate 20A is placed in the mold cavity for performing a molding process, which is used to form an encapsulant 24 for encapsulating the heat sink module plate 23A, the chips 21, the gold wires 22 and the substrate module plate 20A. As the combined structure is dimensioned for the gold layer 233A on the heat sink module plate 23A to be properly spaced from the top wall of the mold cavity after the engagement of the molds, no cracks caused by clamping force from the molds or the heat sink module plate 23 will be generated for the chips 21. Further, as there is no concern for precisely controlling the height of the attachment of the heat sink module plate 23A to the chips 21, quality and reliability of the fabricated product can be assured".

Huang et al. not only fails to teach or suggest the step of "molding the semiconductor die, the substrate, the wire bonds, said die adapter, said at least one collapsible spacer and said heat spreader into a molding compound by molding in a mold cavity between said heat spreader and said substrate, resulting in a molded package having said at least a portion of said substrate exposed and at least a portion of said heat spreader exposed prior to singulating" as recited in Applicants' claims 1 and

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13, but Huang et al. actually teaches away from the present invention. Huang et al. teaches that the combined structure must be dimensioned such that the gold layer on the heat sink module plate is spaced from the top wall of the mold cavity and away from contact with the mold cavity after engagement to the molds. Huang et al. teaches that a space between the heat sink and the upper mold die is important and must be provided.

Since Huang et al teaches that a space between the heat sink and the upper mold die is important and must be provided, this necessarily results in a package having a heat spreader that is covered by a layer of gold which is entirely covered by a layer of molding material, prior to singulation. Thus, Huang et al. clearly teaches away from the present invention as recited in Applicants' claims 1 and 13. The process taught by Huang et al. results in a package that includes a heat spreader (heat sink module plate 23A) that is completely covered by the gold layer 233A, which is completely covered by the molding material 240A. As shown in Figures 2E, 2F and 2G, the molding material covers the gold layer on the heat spreader until after singulation as shown in Figure 2G. Only after singulation of the packages is the molding material (molding resin 240A) removed from the gold layer 233 (Figure 2H). Thus, the molding step taught by Huang et al. cannot possibly result in a molded package having "at least a portion of said substrate exposed and at least a portion of said heat spreader exposed from said package prior to singulating" as recited in Applicants' claims 1 and 13.

Figure 4 of Huang et al., which the Examiner alleged teaches an array of molded packages having at least a portion of said substrate array exposed and at least a portion of said heat spreader exposed, clearly shows a package upon which the further steps of singulating and then separating the molding material from the gold layer, after molding, have been performed. This is, in fact, the purpose of the gold layer, which is to allow for delamination of the molding resin from the gold layer due to the difference in thermal expansion coefficients (See, for example, Paragraph 39 of Huang et al.). Thus, Huang et al. fails to teach or suggest and, in fact, teaches away from an array of molded

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packages having at least a portion of said substrate array exposed and at least a portion of said heat spreader exposed, prior to singulating since Huang et al. teach the advantages of spacing the heat spreader from the mold die.

As noted in the previous Office Action response, it is error to find obviousness where references diverge and teach away from the invention at hand (W.L. Gore & Assoc. v. Garlock Inc., 220 USPQ 303, 311 (Fed. Cir. 1983)).

Since Huang et al. clearly and specifically teaches away from the features of "releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity, such that said other of said heat spreader and said substrate is in contact with said upper mold die" and "molding the semiconductor die, the substrate, the wire bonds, said die adapter, said at least one collapsible spacer and said heat spreader into a molding compound by molding in a mold cavity between said other of said heat spreader and said substrate and said surface of the lower mold die, resulting in a molded package having said at least a portion of said substrate exposed and at least a portion of said heat spreader exposed from said package prior to singulating", as recited in claim 1 and similarly in claim 13, the Examiner cannot simply combine the teachings of Huang et al. with Weber. Thus, Applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness in the rejection of claims 1 and 13 over Huang et al. in view of Weber.

Notwithstanding the above, Applicants' claim 1 has been amended to recite the step of "releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity, such that said other of said heat spreader and said substrate is in contact with said upper mold die and said collapsible spacer is disposed and compressed between said heat spreader and said substrate to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die" (emphasis added). Applicants' claim 13 has been similarly amended.

Huang et al. clearly fails to teach or suggest any step of "releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity,

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such that...said collapsible spacer is disposed and compressed between the heat spreader and said substrate to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die" as recited in Applicants' claim 1, and similarly in Applicants' claim 13. There is no teaching or suggestion of the adhesive taught by Huang et al. being compressed to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die.

Similarly, Weber et al. clearly fails to teach or suggest any step of "releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity, such that...said collapsible spacer is disposed and compressed between the heat spreader and said substrate to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die" as recited in Applicants' claim 1, and similarly in Applicants' claim 13. There is no teaching or suggestion in Weber of the any collapsible spacer, and therefore, there cannot possibly be any teaching or suggestion in Weber of a collapsible spacer being compressed to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of claims 1 and 13 under 35 U.S.C. § 103(a) as being unpatentable over Huang et al. in view of Weber.

The Examiner has relied upon Punzalan et al., Cheng et al., Mayer and Fang to allegedly cure various deficiencies of Huang et al. and Weber. However, none of Punzalan et al., Cheng et al., Mayer and Fang teaches or suggests the steps of "releasably clamping the other of said heat spreader and said substrate to an upper mold die of said mold cavity, such that said other of said heat spreader and said substrate is in contact with said upper mold die and said collapsible spacer is disposed and compressed between said heat spreader and said substrate to thereby press said one of said heat spreader and said substrate against said surface of said lower mold die" and "molding the semiconductor die, the substrate, the wire bonds, said die

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adapter, said at least one collapsible spacer and said heat spreader into a molding compound by molding in a mold cavity between said heat spreader and said substrate, resulting in a molded package having said at least a portion of said substrate exposed and at least a portion of said heat spreader exposed from said molded package prior to singulating" as recited in Applicants' claims 1 and 13.

Accordingly, Applicants respectfully submit that Huang et al., Weber, Punzalan et al., Cheng et al., Mayer and Fang, applied alone or in combination, fail to teach or suggest the unique combination and arrangement of method steps and features recited in Applicants' claims 1 and 13.

In view of the foregoing remarks, Applicants respectfully submit that Claims 1 and 13 are allowable. Claims 2-12, 14-23 and 30-35 depend upon claims 1 and 13, and are therefore allowable for at least the reasons that claims 1 and 13 are allowable.

In view of the foregoing remarks, Applicants respectfully submit that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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